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FORTUNATELY the continually expanding and widely dispersed array of published reports on freshwater jellyfish in North America has been periodically summarized. Dejdar (1934) has contributed the most complete world-wide study, while Schmitt (1939) has summarized the North American records up to 1939. Pennak (1953) has given a recent account of life-history and distribution, while Dexter *et al.* (1949) and Moore (1954) have briefly summarized existing reports and added new records.

There have been very few published records for Canada, and, although there undoubtedly are others, the only one known to the writers is the report of Fantham and Porter (1938). These authors found a few freshwater jellyfish in Horseshoe Lake, near Ste. Agathe des Monts, Quebec (46° N. lat.; 74°25′ W. long.), in late June; they also reported medusae present in September in the Eastern Townships of Quebec, but very close to Rouse's Point, N.Y. (44°58′ N. lat.; 73°22′ W. long.). To the present writers' knowledge, specimens of freshwater jellyfish have never before been collected and recorded from Ontario, and because of the many unknown aspects of the biology of these animals, particularly in more northern areas, the following observations and notes are offered. These describe the occurrence of freshwater medusae in three Ontario localities: Horseshoe Lake, Frontenac County (not to be confused with the Horseshoe Lake of Fantham and Porter (*op. cit.*) which is in Quebec); Lake Nipissing; and Georgian Bay, Lake Huron.

Specimens from the Horseshoe Lake and Georgian Bay localities are in the collection of the Royal Ontario Museum. In general structure these specimens fit the description of *Craspedacusta sowerbii* Lankester given by Pennak (1953). Whether, on the basis of detailed morphological comparison, this material actually falls within the defined limits of *C. sowerbii* remains to be determined by a student of the group.

Horseshoe Lake. In 1955 jellyfish were seen in Horseshoe Lake, Kennebec Township, Frontenac County, from late July until the middle of October. During late August and early September they became particularly conspicuous. At this time they were abundant in the area near the lake's outlet, but were reported distributed generally in Horseshoe Lake and also in Bull Lake, the next lake above it.

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These two lakes, connected by a short narrows, are a part of the Salmon River system.

Near the outlet of Horseshoe Lake, where most of the observations were made, the jellyfish appeared to be confined to the central part of the channel formed by the narrowing lake. Here, in water about seven feet deep, amid dense beds of aquatic plants including *Potamogeton, Elodea,* and water lilies, the jellyfish were most abundant. They were not found, however, in the shallower areas close to shore on either side of this central channel. Since this narrowing area was very close to the outlet of the lake, there was a slight current. Observations made in the river below Horseshoe Lake and in Crotch Lake, about one-half mile downstream, indicated that only a few jellyfish were present in those areas. Jellyfish were reported also from Horseshoe Lake in 1954, but were said to be not so abundant as in 1955. No hydroids were found at any time.

Horseshoe Lake is about 40 miles north of Kingston, Ontario, and lies at a latitude of approximately 44°30′ N. This lake is shaped like a horseshoe, with the distance by water between the two most distant points about two miles. The lake is rather shallow and supports dense beds of submerged aquatic plants.

In a large sample of medusae collected on September 1, 1955, preserved specimens in a relaxed condition range from 1 mm. to about 20 mm. in diameter. All mature specimens examined appear to be females. Freshly collected, live specimens were light green in colour around the radial and circular canals and the gonads. This green colour faded when specimens were kept in aquaria for several days. Although several attempts were made to maintain the jellyfish in aquaria, none of the individuals lived longer than ten days.

Lake Nipissing. The second Ontario record is from Lake Nipissing where jellyfish were first recorded by Mr. H. Crook, who saw a few individuals, but only one or two at a time, while skin-diving during the last week of July, 1955. All the specimens seen by him were in South Bay, Lake Nipissing, and were located within two feet of the surface, in water six to nine feet deep.

On August 10, 1955, specimens from the Southeast Bay area of Lake Nipissing were submitted to Mr. C. O. Bartlett, District Biologist with the Ontario Department of Lands and Forests, who identified them as freshwater jellyfish. Mr. Bartlett states that the jellyfish were reported to be very numerous in the bay at that time. As far as Mr. Bartlett was able to determine from field officers of the Department in that area, freshwater jellyfish had not been reported before in Lake Nipissing.

These two parts of Lake Nipissing, South Bay and Southeast Bay,

are adjoining bays on the southern shore of the lake and lie at a latitude of approximately 46°10′ N. No specimens from this area have been seen by the present writers.

Georgian Bay. The third record is from Georgian Bay, Lake Huron, where, on October 9, 1952, jellyfish were seen in large numbers around the boat slips within the inner harbour of the town of Parry Sound (45°20′ N. lat.). When first seen the jellyfish were confined to a relatively small area at the end of the harbour, but during the day the group dispersed. Over the four succeeding days the individuals became more widely scattered throughout the harbour, then disappeared and were not seen again. They were reported to have also occurred at a point about 350 yards along the shore from the group observed. Jellyfish have not been reported from the Parry Sound area in succeeding years.

In the part of the harbour where the jellyfish were first seen, the water depth was about eight feet, while in the central part of the harbour to which they later dispersed the depth was about fifteen feet. The medusae were seen at the water surface and down to a depth of about six feet, beyond which limited visibility prevented observation. Beds of aquatic plants, including *Potamogeton* and *Elodea*, were common in the harbour.

A small collection of medusae was made, and of the 13 individuals available to the present writers, the diameter of the preserved specimens in a relaxed condition ranges from 12 to 16 mm. All the specimens in this collection appear to be females.

It is believed that Georgian Bay, continuous as it is with the main body of Lake Huron, is the largest body of water from which freshwater jellyfish have been recorded in North America.

Feeding. Some of the medusae collected at Horseshoe Lake were maintained in aquaria for periods up to ten days and their feeding activity was observed.

Shortly after the jellyfish were first placed in aquaria, numbers of daphnids were added to some of the tanks. When these came in contact with the tentacles of the medusae, they were held for varying periods of time. Some, retained in the tentacles for a few seconds, became free again and fell slowly with a slight quivering motion to the bottom of the aquarium where they bounded about with erratic movements. Some of these later returned to normal swimming activity while others died. Examination of those daphnids swimming erratically on the bottom of the aquarium showed that in each instance one of the swimming appendages or antennae was not functioning, while the normal movement of the other resulted in the unbalanced

swimming motion. It is assumed that the impaired activity or death of the crustaceans was a result of the action of the nematocysts of the medusae.

Since there were large numbers of daphnids in the water with the medusae, contact with the tentacles was often seen. Once captured in the tentacles, the daphnids were readily passed into the manubrium and as many as three were seen in the gastrovascular cavity of a single medusa at one time.

Periodicity in Movement. The evidence on periodic vertical movements of freshwater medusae is not all in agreement. Payne's (1924) observations clearly outline one view, and are best stated in his own words: "Their appearance at the surface is somewhat irregular. They move up and down. At times these movements are at frequent intervals; at other times it may be hours or perhaps a day when not one or only a few will be seen near the surface. Again they may be plentiful in the morning hours and then disappear until about three o'clock in the afternoon. I have seen them abundant in the middle of a bright sunny day. On the whole, my observations indicate that they are less abundant on dark cloudy days. One might expect their movements to depend somewhat upon the light, yet they are so irregular that I have found it impossible to say that light plays an essential role." These comments were based on Payne's study of medusae in Boss Lake, Indiana, where all individuals examined were females.

Dejdar (1934), in summarizing the reports for *C. sowerbii* up until that time, cites Romanes' (1880) observations on medusae in artificial pools for evidence that freshwater medusae swim near the water surface during periods of sunlight, but go to lower depths when the sun disappears. He further states that other observers, particularly those working with medusae in natural environments, are in agreement with Romanes. Dejdar, however, then cites Payne (*loc. cit.*), implying that this author's evidence supports his generalization. Unfortunately, reference is made to only one of Payne's statements (Dejdar, p. 58; translated from the original German): "Payne (1924) was able to find the medusae especially abundant in the middle of clear sunny days, while with cloudy skies his collections were less abundant." Taken out of its original context in this way, this statement is misleading and does not represent Payne's conclusion concerning vertical movements of medusae and their possible correlation with light, as quoted above.

Milne (1938) is in agreement with Payne on the highly erratic behaviour, noting the medusae abundant on some days and scarce on others. He found, however, that there was no periodic movement and that the general activity of the jellyfish during the night was no

different from that during the day. These observations were made on medusae in an artificial lake in Virginia and all individuals examined were females.

Reporting on a population of jellyfish in a pond in Ohio, Kraatz (1933) found scarcely any medusae in sunny weather at midday, while large numbers were in evidence at sundown. Woodhead (1933), on the other hand, reported medusae abundant on bright sunny days and none on dark cloudy days. His observations were made on a population in a pond in Michigan.

In the case of the Horseshoe Lake jellyfish in Ontario, described in the present paper, no extended observations on behaviour were made. At the time when the lake was visited, however, periodicity in vertical movement was apparent and this seemed to be closely linked with periods of bright sunlight. In August and September, the medusae were abundant near the water surface and were readily collected when the sun was shining brightly, but when the sun was obscured the medusae remained deep enough in the water to be out of sight and only isolated individuals were found in the same area where they had been previously abundant. It is believed that all specimens examined from this population were females.

Possibly some of the conflict in these reports can be resolved through more complete observation. Other independent factors doubtless influence vertical movement as well. Allyn and Rettger (1932), for example, in describing a population of female medusae in Indiana, note the disappearance of medusae from the surface water almost simultaneously with the appearance of wind-blown ripples. It does seem clear, however, that Dejdar's generalization concerning the positive reaction to light of medusae of *C. sowerbii* allows considerable room for qualification. Even if the current trend to assign existing North American and European records to *C. sowerbii* is correct (Pennak, 1953), infra-specific variation in certain characteristics, such as behaviour, remains a possibility.

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